THE NEXT SAFETY BREAKTHROUGH

(How Do We Get There?)

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Sit Back …

Relax A Bit ----

Let's Do Some …

"Blue Sky"

Thinking

5, 10, or Even 100 Years Hence …

Will **Safety Breakthroughs** *be Needed For:*

--- Much S*afer, Faster, and Less-Expensive* Work Performance ---

When Managing Chemical Hazards?

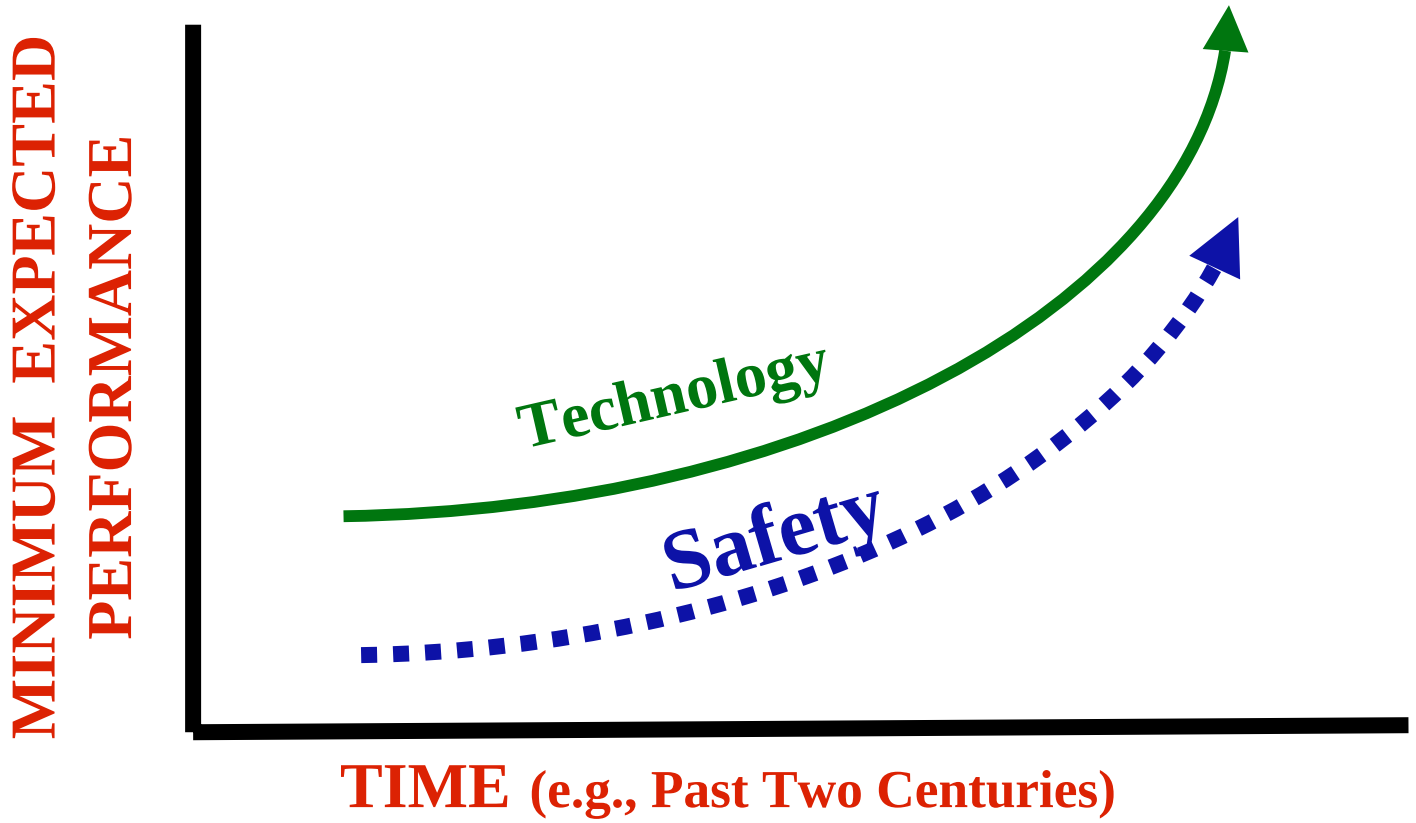
In Other Words ...

- *Do We Still Have Important Chemical Safety Management Principles Left to Discover -- (or)*

- *Are There Only:*

  Implementation Refinements Left?

Safety Expectations Will Probably Continue To Rise **(As Will Safety Costs)**



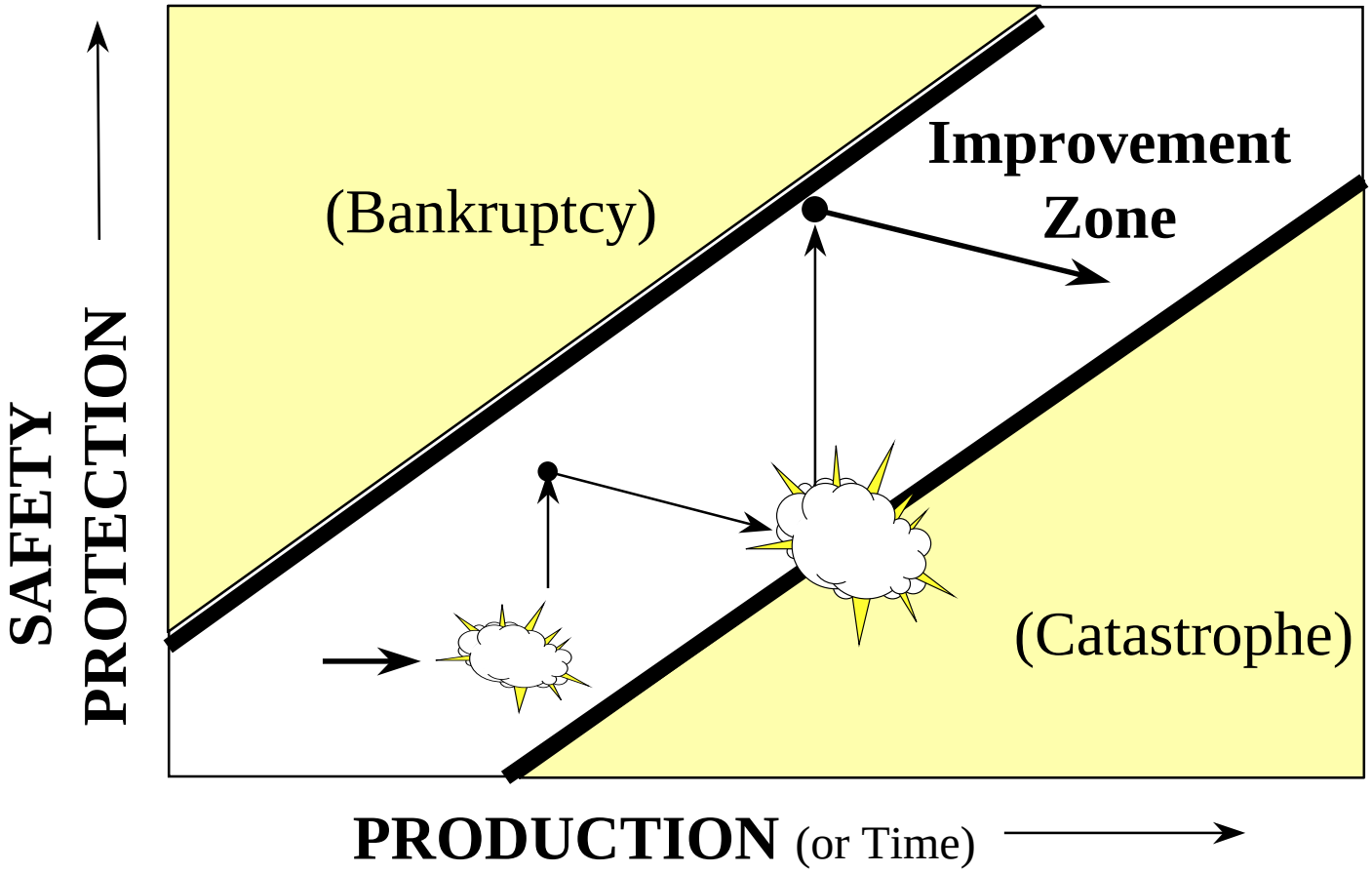
Also, Even Today ---

Accidents and Disasters Are Too-Often Essential Prerequisites for Substantial Safety Improvement

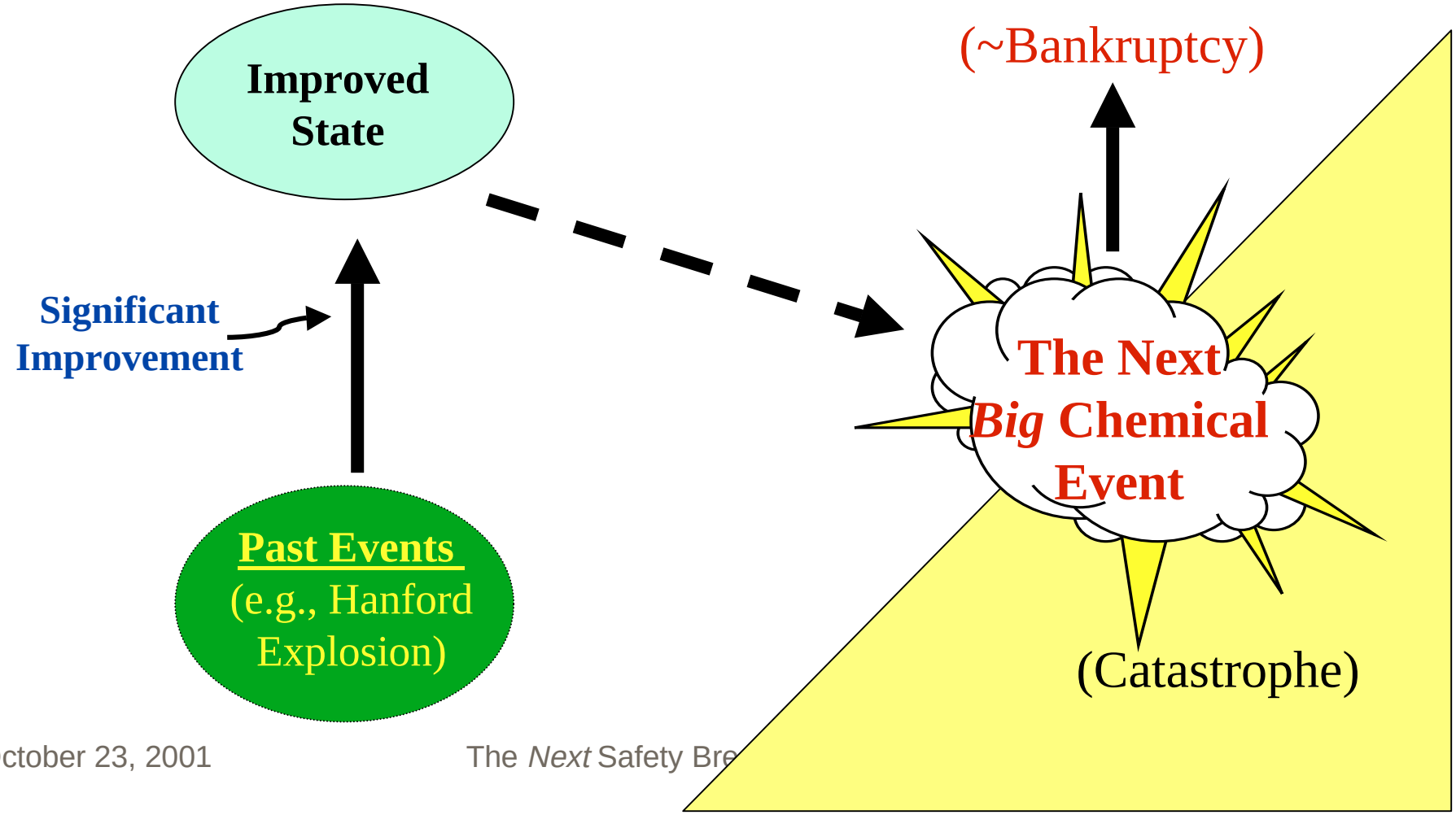
Would Major Improvements Have Occurred -- ??

- *In Chemical Safety, Without*
  - The Bhopal Catastrophe, The Hanford Explosion, or Other Past Chemical Accidents and Disasters?
- *In Nuclear Safety, Without*
  - The Three Mile Island Accident, The Chernobyl Disaster, The Widespread '90s Facility Shutdowns, or The Recent Japanese Criticality Accident?
- *Even in Airline Security, Without*
  - The '70s Hijackings or The Recent World Trade Center Tragedy ...?

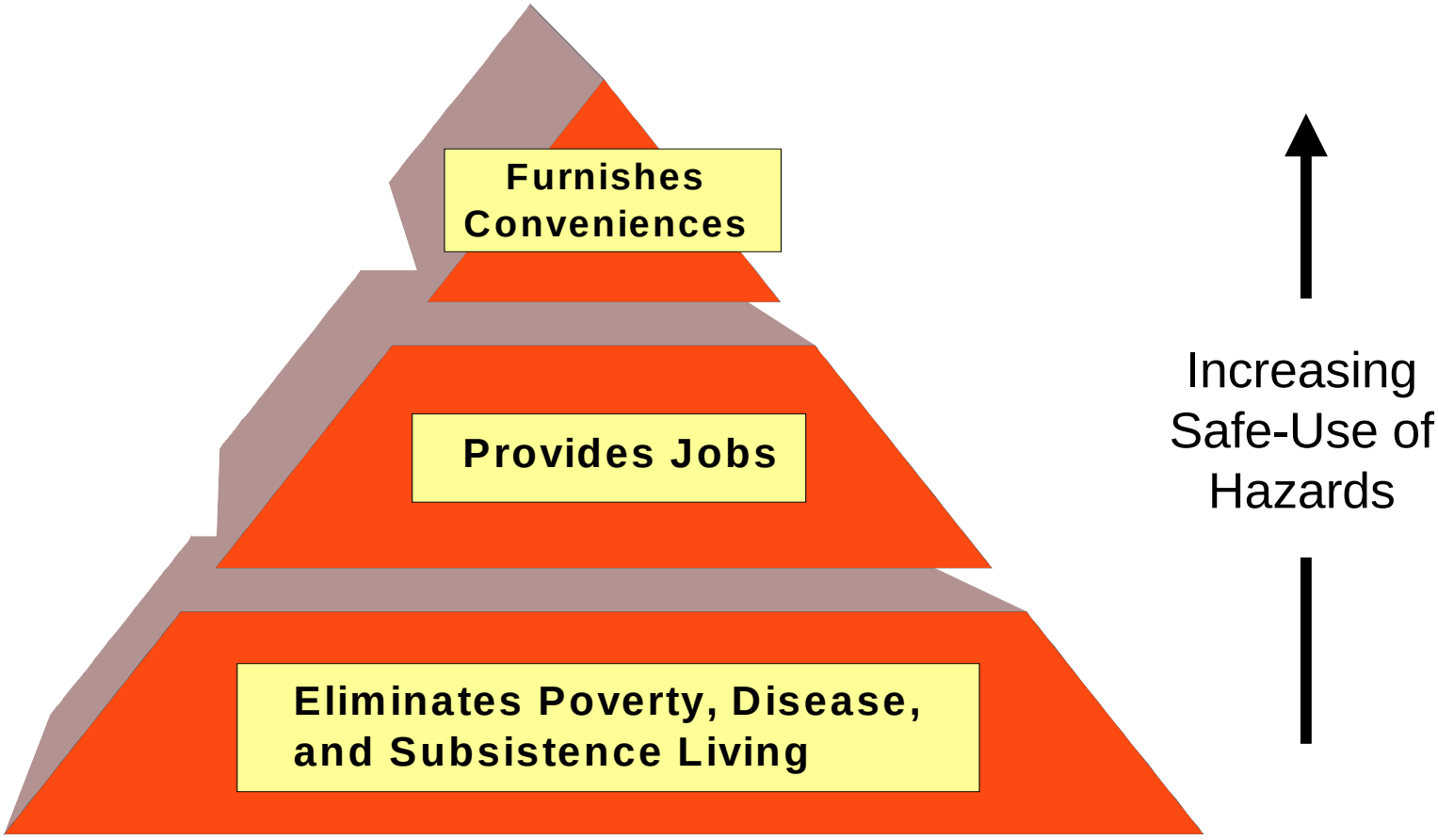
Event-Driven Improvement Appears "*Alive and Well*" (Dr. Reason's Curve)



The Ultimate "*Hazard Analysis*" Challenge is Getting Off Reason's Curve

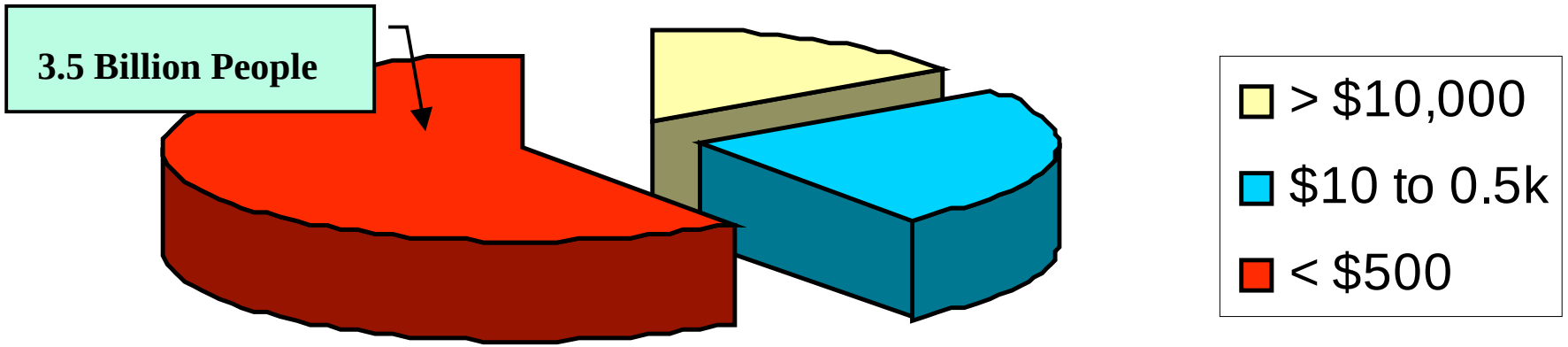


Beyond Benefits to DOE, The Safe Use of Hazard-Based-Technologies Helps Mankind



Much of the World Needs these Benefits *Now* -- At Significantly Lower Cost

World Annual Per Capita Gross National Products



(Reference: New York Times 2001 Almanac)

Given All This …

The Pursuit of Safety "Breakthroughs"

To Substantially Improve Safety Protection and Significantly Cut Safe-Work Costs

… Is A *Tempting* Path, Although Not An Easy One.

Where Do We Look? -----

Breakthroughs Could Lie In The:

Deeply Rooted,

Profound,

and Very Complex

Foundational-Drivers Intertwined with Hazard Management ***Decision-Making***

These Drivers Can Be Very Complex – and *Poorly* Understood

- For Example: *What Ultimately Caused the Department To Fall So Far Behind in Safety Management in the '80s?*
  - Was it Driven By:
    - - Long-Term (Indirect) Effects of DOE's ***Budget Drivers and Processes?***
    - - Numerous Factors Limiting ***Federal Staff Safety Accountability***
    - - Other Foundational-Drivers???

Have Others Added Breakthroughs to Their Corporate Strategies???

- *Yes, For Example:*

  The Computer Technology of Today is Linked to a Corporate Breakthrough Strategy from Early in the Last Century ...

Consider The Crisis That AT&T Faced In 1907 …

- *Key Patents Were Expiring*
- *Competitors Were At Their Throats*
- *Lacking a Practical Amplifier, Transcontinental Telephone Service Was Still ~~ Only a Dream*

(After Much Internal Debate, AT&T Settled on a Breakthrough Strategy)

The Strategy Worked, They Found Their Breakthrough!

The Vacuum Tube

A Powerful New Tool – Which Smashed Old Performance Limits

(Enabling Transcontinental Service and Opening Up a New Age of Electronics)

Four Decades Later ...

While Others Were Focused on
Improving Vacuum Tubes ...

- *Mervin Kelly (at AT&T) Embarked Upon Another Breakthrough Strategy.*

-- To Overcome Vacuum Tube Performance Limits (Power, Heat, Reliability) ...

… He Made a *Research and Development* Commitment

- *In 1945, He Created A Semiconductor Research Program at Bell Labs*
  - "Hells Bells Lab"
  - It produced a working **Transistor** in 1948
  - Previous performance Limits Were Again -- ***Smashed!***
- *The Next Breakthrough (Not AT&T This Time – Texas Instruments and Fairchild Semiconductor) Was The Microchip (1958)*

So …. How Might We Develop Safety Breakthroughs?

1) First, Understand The Breakthrough Concept, --- then

2) Define ISM's Inherent Performance Limits,

3) Decide to Go After Breakthroughs,

How Might We … (Continued)

4) Develop Desired Output Objectives (Integrated Outcomes) Tied to Substantial Performance Improvement,

5) Formulate A Breakthrough Strategy (Such as ISM R&D) and A Practical Game-Plan, and

6) Measure Progress towards the Enhanced Outcomes

What Are ISM's Inherent Performance Limits?

Three Are Proposed:

1) Accident-Driven Safety Improvement (Reason's Curve)

2) Generalized Retrospective-Based Decision Making

3) Axiom-Driven, Rather than Science-Based, Conceptual Modeling

To Develop Breakthroughs, We Need to Talk About These Limits

- *Consider the Third Limitation: Axiom-Based Modeling*
  - Axioms are "Self-Evident" Truths
    - Based Upon Ad Hoc, Anecdotal Experiences
    - Very Useful and Important Components of Human Knowledge
    - Axioms are Often Correct (Within their Level of Precision)

ISM's Third Limitation (Continued)

Being Considered "Self-Evident Truth" Has its Drawbacks ...

- It Tends to Generate Intellectual *Dead-Ends.*
- In Axiom-Based Constructs, First Principles Can **not** be As Precisely Characterized, As Easily Challenged, nor As Easily Enhanced -- As They Can In Science-Based Constructs.

Nobel-Prize-Winning Physicist, Richard Feynman, Described Science-Based Models This Way …

> *"There is always the possibility of proving a definite theory wrong; but notice that we can never prove it right. Suppose that you invent a good guess, calculate the consequences, and discover every time that the consequences you have calculated agree with experiment. The theory then is right? No, it is simply not proved wrong."*
>
> – *The Character of Physical Law*

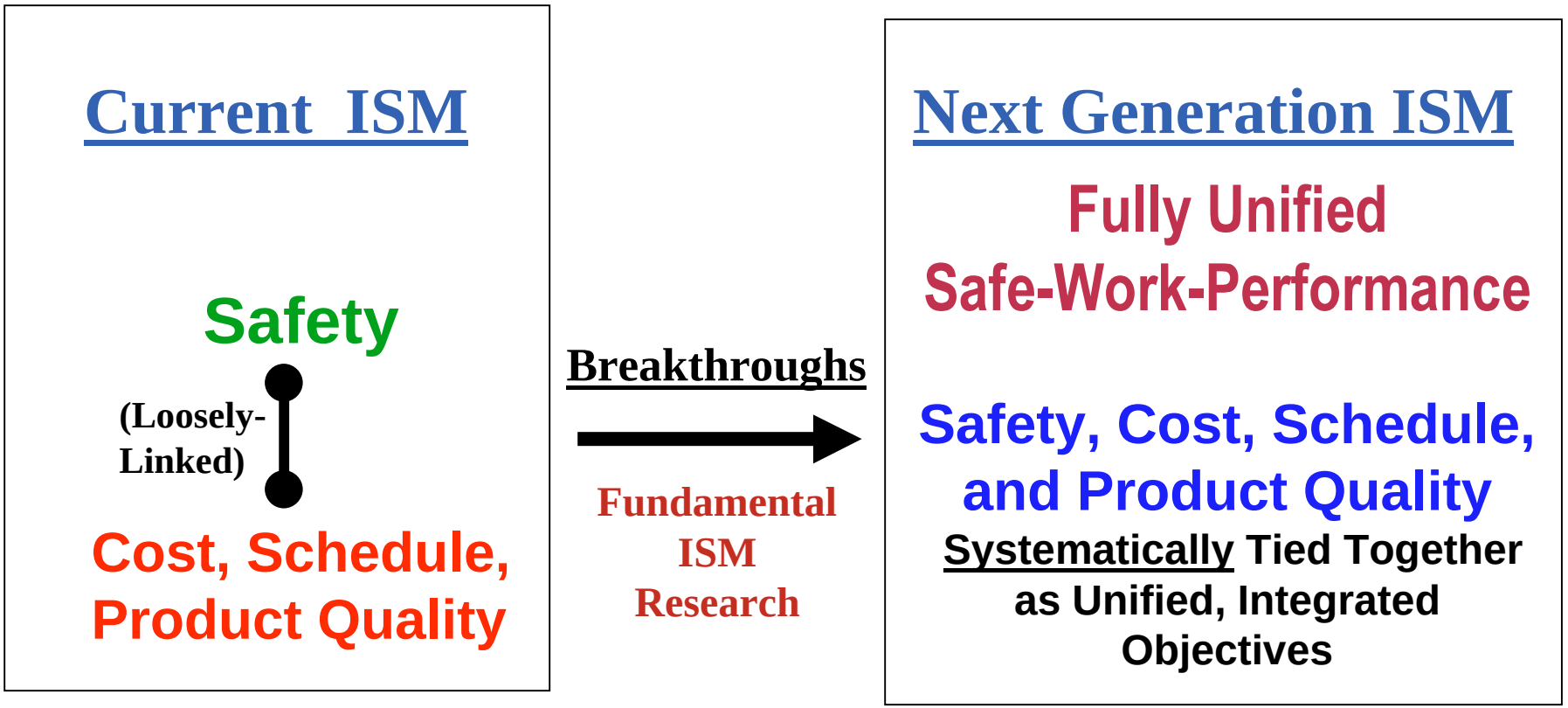
Moving the ISM Model Towards A Science-Basis Has Many Advantages

- *It Unleashes the* Power of the Scientific Method *in the Search for Safety Management Breakthroughs, Through:*

Fundamental, Applied ISM Research and Development

(Utilizing Actual Workplaces and Workforces)

... Bringing on The Next Generation of Chemical Management (and ISM)



The Breakthroughs are Out There, Waiting For Us …

- We Can Dramatically Shape the Future of Chemical Management
  - *Will it Be:*
    - *More and Better Chemical Management Vacuum Tubes?*
    - *(or) Transistors and Microchips?*

The Possibilities Are Truly Exciting …

Finished At Last!

- *Thanks for Listening …*
- For More Discussion of Safety Breakthroughs, Including Additional Suggestions on *Promising ISM Research Areas*, Please See The Full Paper at:

http://www.oakridge.doe.gov/Foia/Next Safety Breakthrough.pdf